

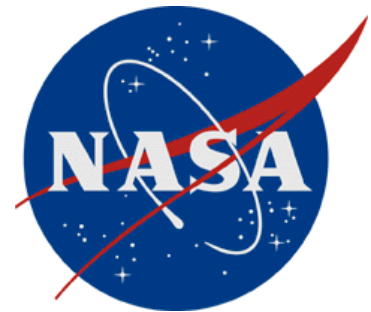
Solar Spectral Flux Radiometer (SSFR)

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NASA Ames Research Center: Warren Gore

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ATTREX Science Team Meeting



Solar Spectral Flux Radiometer (SSFR)

Objective: To support ATTREX by measuring solar (shortwave) and terrestrial (thermal infrared) radiation for determining radiative heating and radiative forcing. (*Schmidt & Pilewskie science talk on Thursday*)

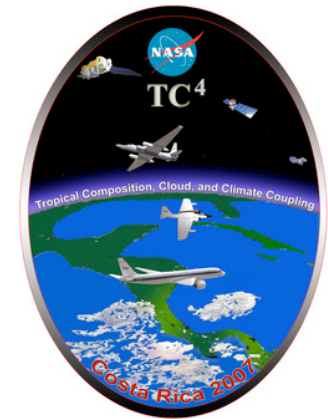
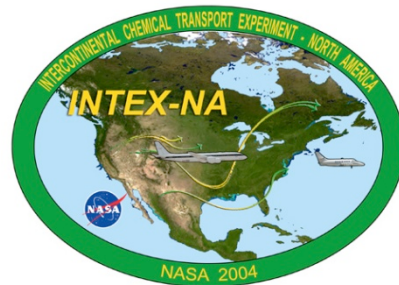
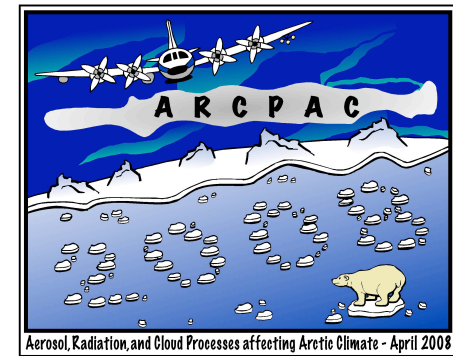
- The SSFR covers from near-ultraviolet to near-infrared, from 360 nm to 2200 nm, or $\sim 95\%$ of the TOA solar irradiance.
- The Kipp & Zonen CG4 pyrgeometer provides broadband infrared irradiance from 4.5-42 μm .
- The two instruments together provide complete measurements required for cloud energy budget analysis, radiative forcing, heating rates, and cloud remote sensing.
- The spectral resolution of SSFR is crucial to distinguish radiative effects of clouds from those of, e.g., the underlying surface.
- It allows an independent retrieval of cloud optical thickness and effective droplet or crystal radius.

Solar Spectral Flux Radiometer (SSFR)

SSFR participated in many field campaigns sponsored by NASA and other agencies and contributed with unique measurements.

**CALNEX
2010**

Air Quality &
Climate Change
Field Study



2006 GoMACCS

Solar Spectral Flux Radiometer (SSFR)

SSFR integrated in many airborne platforms.



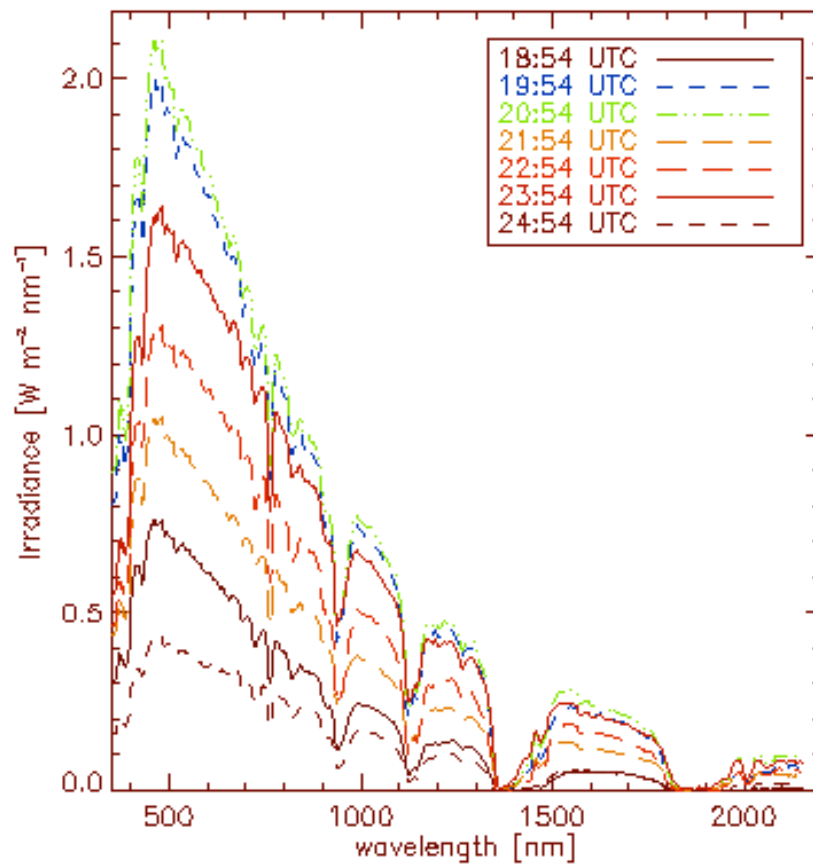
Solar Spectral Flux Radiometer (SSFR)

- Wavelength range: 360 nm to 2200 nm
- Spectral resolution: $\sim 8\text{-}12$ nm
- Simultaneous zenith and nadir viewing
- Hemispheric FOV
- Sampling rate: 1 Hz
- Accuracy: $\sim 3\%$; precision: 0.1%
- Measured quantities: Upwelling and downwelling spectral irradiance [$\text{W m}^{-2} \text{nm}^{-1}$]
- Derived quantities: Spectral albedo, net flux, flux divergence (absorption), and fractional absorption
- Retrieved cloud properties: r_e , τ , LWP

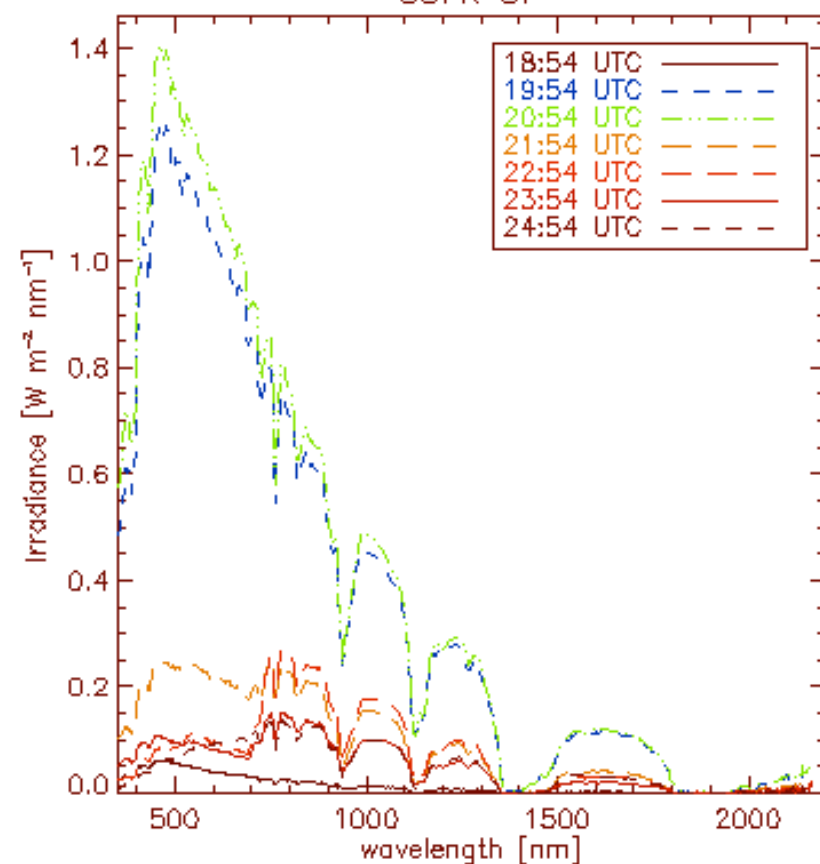


Recent measurements with SSFR

(CalNex experiment, May 16, 2010)



Downwelling spectral shortwave irradiance (SSFR)



Upwelling spectral shortwave irradiance (SSFR)

Solar Spectral Flux Radiometer (SSFR)

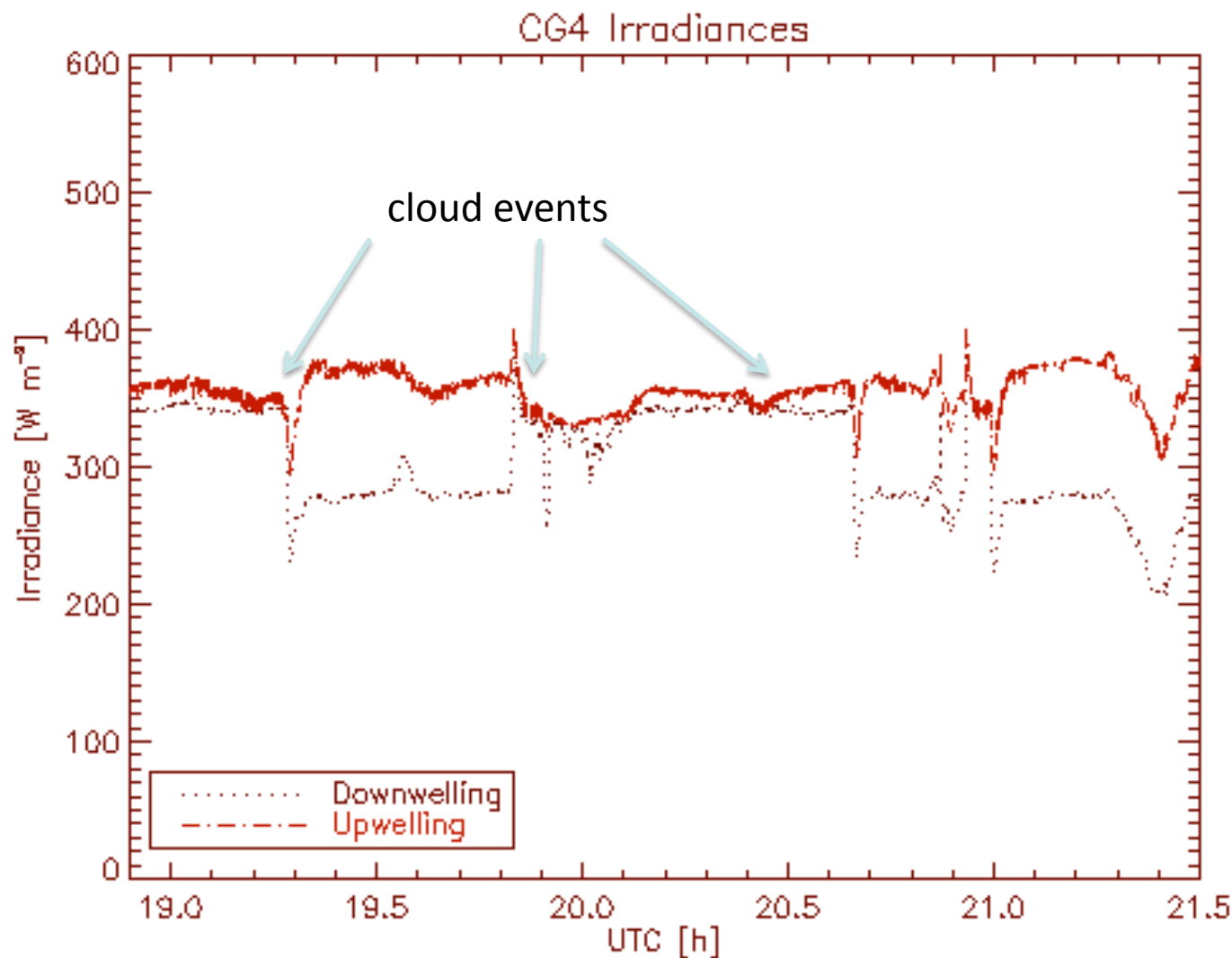
Kipp & Zonen CG4 pyrgeometer

- Wavelength range: 4.5-42 μm
- Simultaneous zenith and nadir viewing
- Hemispheric FOV
- Sampling rate: 1 Hz
- Measured quantities: Upwelling and downwelling broadband infrared irradiance [W m^{-2}]



Recent measurements with CG-4

(CalNex experiment, May 16, 2010)



Downwelling and upwelling broadband IR irradiance (CG-4)

Solar Spectral Flux Radiometer (SSFR)

Calibration:

SSFR

- Pre-mission calibration: spectral and angular response, and absolute radiometric.
- Post-mission calibration: absolute radiometric.
- During mission: radiometric traced to 1000 W lab standard to monitor instrument stability over the duration of the experiment.



CG-4

- Pre-mission calibration: absolute power with reference at the National Renewable Energy Laboratory (NREL) standards.

Solar Spectral Flux Radiometer (SSFR)

Global Hawk integration and operational challenges:

- Locating zenith position for SSFR light collector and CG4 sensor with unobstructed field-of-view.



NOAA WP-3D installation